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ON *PSEUDOCORYNACTIS* SPECIES AND ANOTHER RELATED GENUS FROM THE INDO-PACIFIC (ANTHOZOA: CORALLIMORPHIDAE)

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ABSTRACT

Tentacles development is important for the Corallimorphidae in terms of speciation, being interesting to discuss about the presence of different evolutionary levels in tentacle anatomy.

We studied three species of Corallimorpharia belonging two of them to *Pseudocorynactis* and one to the new genus *Paracorynactis*. The extendible capability of the tentacles is proposed to make difference among the above mentioned genera. The species *Pseudocorynactis globulifera* from the Red Sea is include in this genus for the first time, we also have described the new species *Pseudocorynactis tuberculata* from Indonesia and Maldives. The help control of *Paracorynactis hoplites* on the crown of thorns sea stars population is exposed.

Key words: Corallimorpharians, tentacles extendible capacity, new genus, new species, new combination, Indo-Pacific region.

RESUMEN

El desarrollo tentacular es importante para comprender los procesos de especiación en la familia Corallimorphidae y poder discutir acerca de la existencia de niveles evolutivos relacionados con la anatomía de los tentáculos.

En este artículo estudiamos tres especies de Corallimorpharia pertenecientes dos al género *Pseudocorynactis* y una al nuevo género *Paracorynactis*. La capacidad de extensión de los tentáculos es una característica que proponemos para diferenciar los géneros. Incluimos a la especie *Pseudocorynactis globulifera* en este género por primera vez y también se describe una nueva especie, *Pseudocorynactis tuberculata*, a partir de material procedente de Indonesia y las Maldivas. Es interesante destacar la capacidad de la especie *Paracorynactis hoplites* para ejercer cierto control sobre las poblaciones de la

estrella de mar corona de pinchos que tantos estragos causa a los madreporarios en el Indo-Pacífico.

Palabras claves: Corallimorpharia, capacidad de extensión de los tentáculos, nuevo género, nueva especie, nueva combinación, región Indopacífica.

1. INTRODUCTION

The genus *Pseudocorynactis* was described by den HARTOG [12] to accommodate a new group of Corallimorpharians from the Caribbean, with extremely well developed acrospheres. A species from the same genus was found in the Canary Islands, and den HARTOG *et al.* [15] added some additional characteristics, which increased the knowledge of this species. After these descriptions, new material with *Pseudocorynactis* resemblance was collected in the Indo-pacific region and provisional names were added to images of these species printed in several sea life identification guides (den HARTOG [14]; GOSLINER *et al.* [8]; COLIN & ARNESON [6]). Moreover, the name *Pseudocorynactis* showed up in other publications dealing with a range of marine subjects (see TOMASCIK *et al.* [19]; BOS *et al.* [2]). Meanwhile, some classical papers keep descriptions of Corallimorpharians from the tropical Indo-Pacific region, such as the genus *Corynactis* (see KLUNZINGER [16]; HADDON & SHACKLETON [11]; HADDON [9]; CARLGREN [4], [5]). *Corynactis globuligera* described by Ehrenberg, 1834 (see KLUZINGER, *op. cit.*) from Red Sea and *Corynactis hoplites* by HADDON & SHACKLETON (*op. cit.*) from Flores Sea, are good samples of this assertion.

The family Corallimorphidae includes the genera *Corynactis*, *Pseudocorynactis*, *Corallimorphus* and also *Nectactis* and *Sideractis* (see den HARTOG *et al.*, *op. cit.*). In the present paper a new genus, *Paracorynactis,* is introduced and described, in order to accommodate one of the species studied. From our point of view, tentacles development is important for the Corallimorphidae in terms of speciation. Morphologically, size, type and quantity of nematocysts differ among genera, whereas acrosphere development and stalk differentiation may also differ. Following the differences in the acrosphere development degrees, it is possible to assume the presence of different evolutionary levels in tentacle anatomy which justifies a newly proposed genus. The genera *Corynactis*, *Paracorynactis* and *Pseudocorynactis* follow three different steps in tentacle development which relates to both acrospheres and the stalk. The genus *Corynactis* has the less acrosphere development in the family and a limited stalk extension capacity. *Paracorynactis* shows high acrosphere development and has an intermediate capacity of stalk extension; whereas the genus *Pseudocorynactis* has a more advanced strategy in extending the tentacles stalk and high acrosphere development. All *Corynactis* species known today follow this concept (Ocaña in prep.).

The present study deals with material collected in Indonesia (Sulawesi, Sumbawa, Salayer, Tukang Besi islands, Sumba, Komodo) and Maldives by the National Museum of Natural History (formally RMNH). Material from Aden, Zanzibar, and Siam was additionally studied.

The macro-anatomical analysis of the used specimens was adequate to detect differences at species level. Histological slides are stored at the National Museum of Natural History in Leiden and are available to further study the different genera.

2. MATERIAL AND METHODS

The specimens studied come from different locations within the Indo-Pacific region. The majority was collected by scuba divers, but some were collected with a "van Veen" grab or a rectangular dredge. Samples were fixed with 8-10% formaldehyde and later stored in 70% alcohol in the collections of the National Museum of Natural History in Leiden, The Netherlands. All the type material is deposited at the RMNH in Leiden. General morphology and anatomy were studied by means of a stereo dissecting microscope. The anatomical and micro anatomical details were studied using staining in toto. Nematocysts (>1500 capsules measured) were examined with a light microscope equipped with a Nomarski differential interference contrast optic system. The classification and terminology of nematocysts follows that of SCHMIDT [18], as adapted by den HARTOG [12: 7-9] and den HARTOG *et al.* (*op. cit.*). The surveys of the cnidom are summarized in tables in which the means and ranges of length and width of nematocysts are included. The following codes are used in the tables: vc: very common; c: common; rc: rather common; uc: uncommon; r: rare.

Between October 2007 and November 2008, life specimens of *Paracorynactis hoplites* were observed and measured in Samal Island in the Davao Gulf, the Philippines. The diameter of the polyps was measured with calipers (0.5 cm accuracy) and their depth was recorded (1 m accuracy). These observations were done during SCUBA-dives with a maximum depth of 40 m.

3. RESULTS AND DISCUSSION

Taxonomical key for genera of the Corallimorphidae:

Acrospheres very prominent, clearly differentiated from stalk and contain special spirocysts (den HARTOG, 1980 and den HARTOG *et al.*, 1993) 1

Acrospheres conspicuous but usually not very prominent and differentiated from stalk; the special spirocysts are always absent 2

1a. Stalk highly extendible (more than the column length), nematocysts absent from the stalk ..... *Pseudocorynactis*

1b. Stalk much less extendible, nematocysts present in the stalk ..... *Paracorynactis*

2a. Small gregarious forms living in intertidal and shallow waters, disc tentacles present ..... *Corynactis*

2b. Small or large forms without disc tentacles, apparently never recorded gregarious and living in deep-waters 3

3a. Large solitary forms, low developed tentacles and two categories of spirulae in tentacles ..... *Corallimorphus*

3b. Small forms from deep waters with one small spirulae category in acrospheres 4

4a. Presence of large atrichs in acrospheres and several categories of nematocysts in tentacles, usually attached to hard susbstratum ..... *Sideractis*

4b. Nematocysts similar to those of Corallimorphus, but (apparently) not a sessile animal/species ..... *Nectactis*

Genus *Paracorynactis* gen. nov.

Diagnosis: Solitary form which may reach a relatively large size (diameter of the oral disc 10 to 15 cm); clones have never been observed; 3 to 5 radial rows of tentacles concentrate at the disc periphery, this character is much more conspicuous in expanded conditions. The most developed tentacles are concentrated in the disc periphery and at the margin. Tentacle stalks with medium to moderate extending capacity; nematocysts of several categories present in the stalk. All mesenteries are perfect and provided with restricted enlarged parietal ridges. Cnidom: there are big special spirocysts (length >100 μm) in the acrospheres, showing the high development of the acrospheres.

Paracorynactis hoplites (Haddon & Shackleton, 1893)
(Figs. 1-3 and 9)

Corynactis hoplites Haddon & Shackleton, 1893: 118-119, no plates, Torres Strait, original description. Haddon, 1898: 467-468, plate XXX figs. 1-4. Torres Strait; Haddon & Duerden, 1896: 153, only a brief reference; Carlgren, 1949, reference and distribution; den Hartog, Ocaña & Brito, 1993: 22, 26 & 27, only references about the lack of information about the species.

Material.- Coll. 31023: Indonesia, N Sulawesi, Selat Lembeh, between Tanjungnanas and Teluk Kungkungan: 01°28'N 125°14'E; steep rocky shore, rockface down to 16 m, coral covered slope; against dark wall in shadow of trees, diving; 28.x.1994. N. Sulawesi Expedition, 1994. 3 specimens. Images of the habitus of the two specimens. 7 cm x 4.5 cm; 5.5 cm x 4 cm; 8 cm x 3.5 cm.
Coll. 31030: Indonesia, SW Sulawesi, Spermonde Archipelago, NNW of Pulau Badi (=20Km NNW of Ujungpandang); 4°57'S 119°17'E, coralreef, under large, thick plate of dead coral, scuba diving, depth 8m. 14.iv.1997. Buginesia prog. UNHAS-NNM. 1 specimen. Images of the habitus of the specimen. Colonized partially by fungi. 2.5 cm x 0.5 cm.
Coll. 31031: Indonesia, SW Sulawesi, Spermonde Archipelago, NNW of Samalona (=7.5 Km W of Ujungpandang); 5°07'S 119°20'E, coral reef, under side of dead coral, scuba diving, depth 5-10 m. 21.ix.1994. Buginesia prog. UNHAS-NNM. 2 specimens, one of them very small. Images of the habitus of the two specimens. 2.3 cm x 1.5 cm; 0.6 cm x 0.2 cm.
Coll. 31036: Sta. S4.114: Indonesia, N of Sumbawa, Bay of Sanggar, 8°19.2'S118°14.4'E, lagoon side of reef barrier, depth -20 m, snorkelling, scuba diving, 21/22-09-84. "Tyro" Indonesian-Dutch Snellius-II Exped. Two specimens. Images of the habitus of the two specimens. 5.5 cm x 2.7 cm; 6 cm x 3.5 cm.
Coll. 31038: Sta. S4. 152: Indonesia, SW Salayer, NW coast of Pulau Guang, 06°21'S 120°27'E, reef flat, round steep wall in cave, scuba diving, 28/29-09-1984. "Tyro" Indonesian-Dutch Snellius-II Exped. One specimen. Images of the habitus of the specimen. 2.5 cm x 1.5 cm.
Coll. 31037: Sta. S4. 152: Indonesia, SW Salayer, NW coast of Pulau Guang, 06°21'S 120°27'E, steep cliff in hole, 4-5 m, snorkeling, 29-09-1984. "Tyro" Indonesian-Dutch Snellius-II Exped. One specimen. Images of the habitus of the specimen. 5 cm x 2.5 cm.

Diagnosis (complete anatomical descriptions in HADDON [9]:

Color in the column is often conservative brown, although tentacles and oral disc should be variable: brown oral disc and translucent tentacles with white longitudinal stripes in the middle of the tentacles, acrospheres of ochre color; grey oral disc and tentacles with white longitudinal stripes not very conspicuous. In preserved material there is no color trace in the acrospheres of the studied specimens.

Irregular base in outline, often spread on substrate. Column well developed with no distinction between scapus and scapulus noticed, although the upper part of the column

seems less corrugate. The diameter in preserved specimens varies from 0.2 to 4.5 centimetres (attending to its trophic behavior, some specimens should be larger; BOS *et al.* [2]), in live specimens the column can reach 10 cm in height. Short radial rows of 2 to 5 ectacmaceus tentacles, large specimens may have up to 180 tentacles or even more. Tentacles are assembled at the disc periphery and marginal areas of the disc. Tentacles stalk with medium to moderate extending capacity, nematocysts of several categories present in the stalk. Acrospheres with a great development of the ectodermic tissues (see cnidom in this study and HADDON, *op. cit*: 467), similar to what was found in the genus *Pseudocorynactis* (den HARTOG *et al.* [15]).

Apparently, the species does not develop siphonoglyphs. The pharynx presents numerous folds. Most mesenteries are complete; they can be 90 to 105 in number and present some incomplete ones growing in the exocoelic (fig. 2c). Among the directives, a couple of endocoelic mesenteries were observed too (fig. 2c). Sphincter more or less enlarged and restricted to the upper part of the column (fig. 2a and b; OCAÑA [17]). Strong ectodermic musculature of the tentacles bearing some mesogloeal process but it does not have a brush like structure (den HARTOG *et al.*, *op. cit.*). Endodermic musculature from the column conspicuous and well developed. Retractors weak, only conspicuous in free mesenteries, restricted just before the cnidoglandular portion of the mesenteries and developing some ridges (fig. 2c). Parietobasilar muscles present well developed enlarged restricted mesogloeal ridges in all the mesenteries (fig. 2c and d).

Cnidom (table I, fig. 3): We analyzed the complete cnidoms of three specimens and, also partially, the tentacles and the body wall of three other specimens. Once the cnidom of the species is well known, the cnidom from the tentacles and the body wall are good indicators to distinguish one species from another. P-mastigophores E from the tentacles of *Paracorynactis hoplites* are larger than in the other species studied in this paper, although there are no relevant differences in the size of the cnidae between small and large specimens. Spirulae from tentacles reflect slight differences between small and large specimens. Big homotrichs from tentacles are common but often appear broken in two parts making measuring difficult. Small p-mastigophores D from tentacles are not very obvious and easily overlooked. In the sample Coll. 31031 a second category of homotrich from tentacles was observed. There are measurement differences linked to specimen sizes (Table I), although

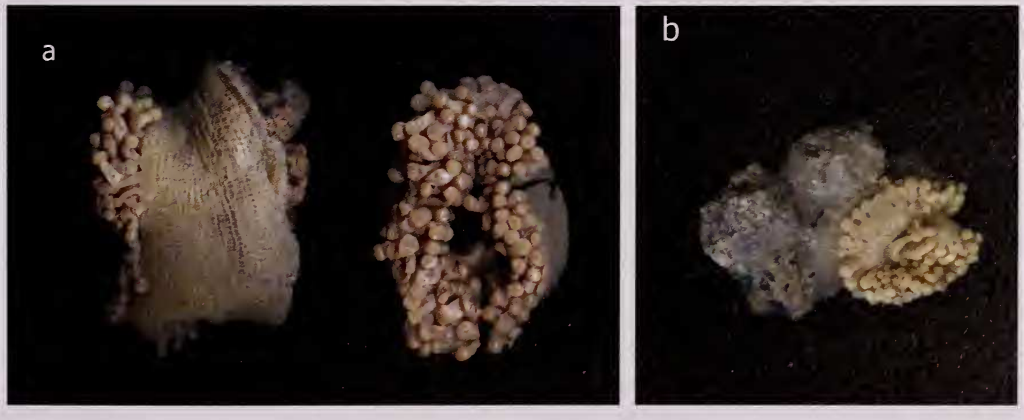


Figura 1.- Features on different specimens of *Paracorynactis hoplites*: **a)** specimen from coll. 31036; **b)** specimen from coll. 31038.

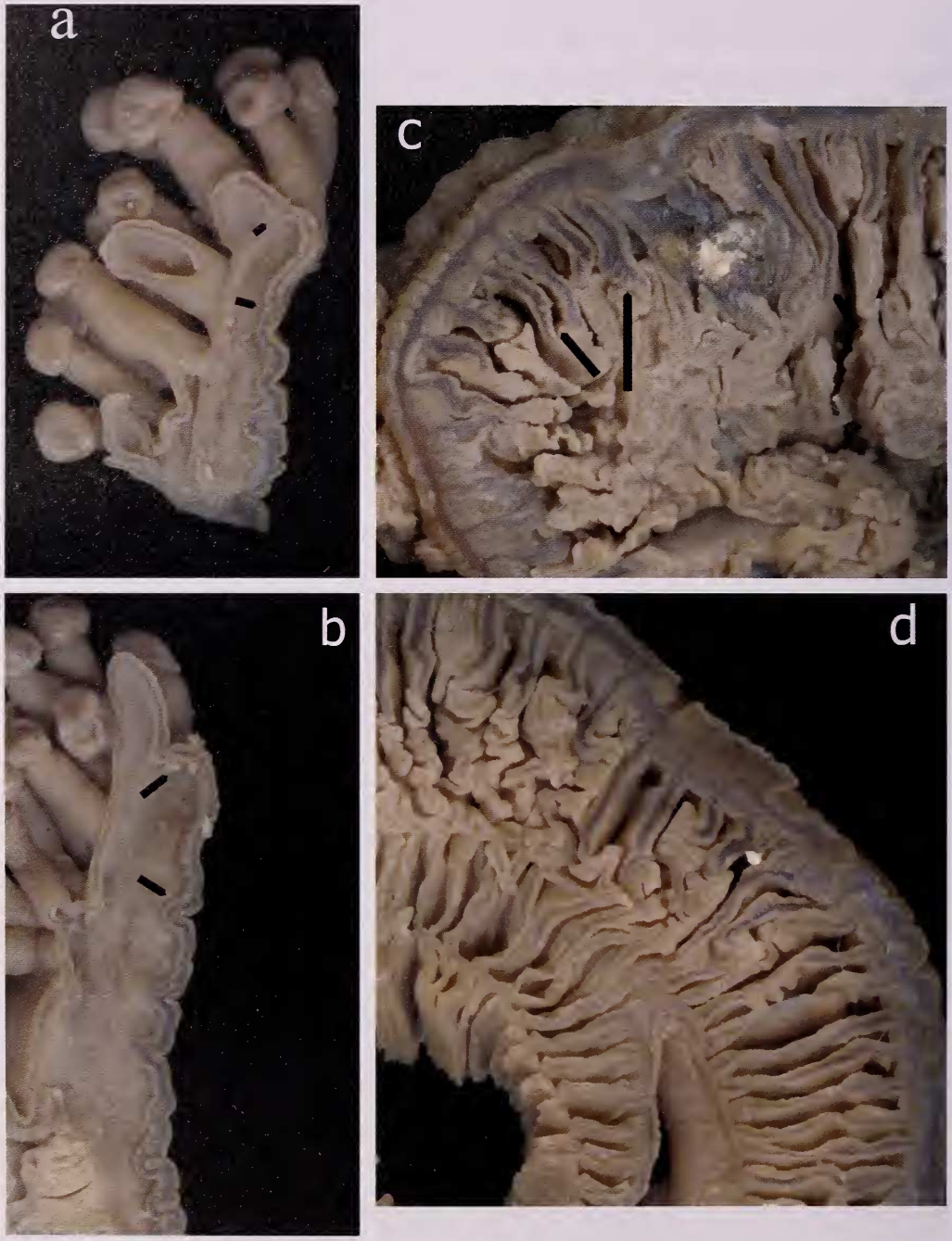


Figura 2.- a) Sphincter development marked by arrows from one specimen of the coll. 31023; **b)** idem in another specimen of the coll. 31023; **c)** mesenteries arrangement and its retractor development from one specimen of the coll. 31023; **d)** mesenteries arrangement and enlarged restricted mesogloeal ridges from one specimen of the coll. 31023.

these are relevant in relation to the intra-specific variability but do not significantly affect the distinction between species. Large specimens usually have longer and wider nematocysts. In a few occasions the opposite was observed; e.g. the specimen 31038 had larger penicilli D in the tentacles.

Due to the poor conditions of the tentacle tissue in specimens 31037, it was not possible to size the homotrichs from the tentacles. There was a second penicilli E category in the filaments of the specimens 31023 and 31030. Due to their rare presence we included the measurement range (53-63 μm) × (22-26 μm). Another very scarce spirulae category was found in the body wall, but possibly it was produced by contamination. In the tentacles we observed another homotrich category of smaller size, inconspicuous and scarce but merit to be studied carefully in order to distinguish the species from other species of the genus *Paracorynactis*.

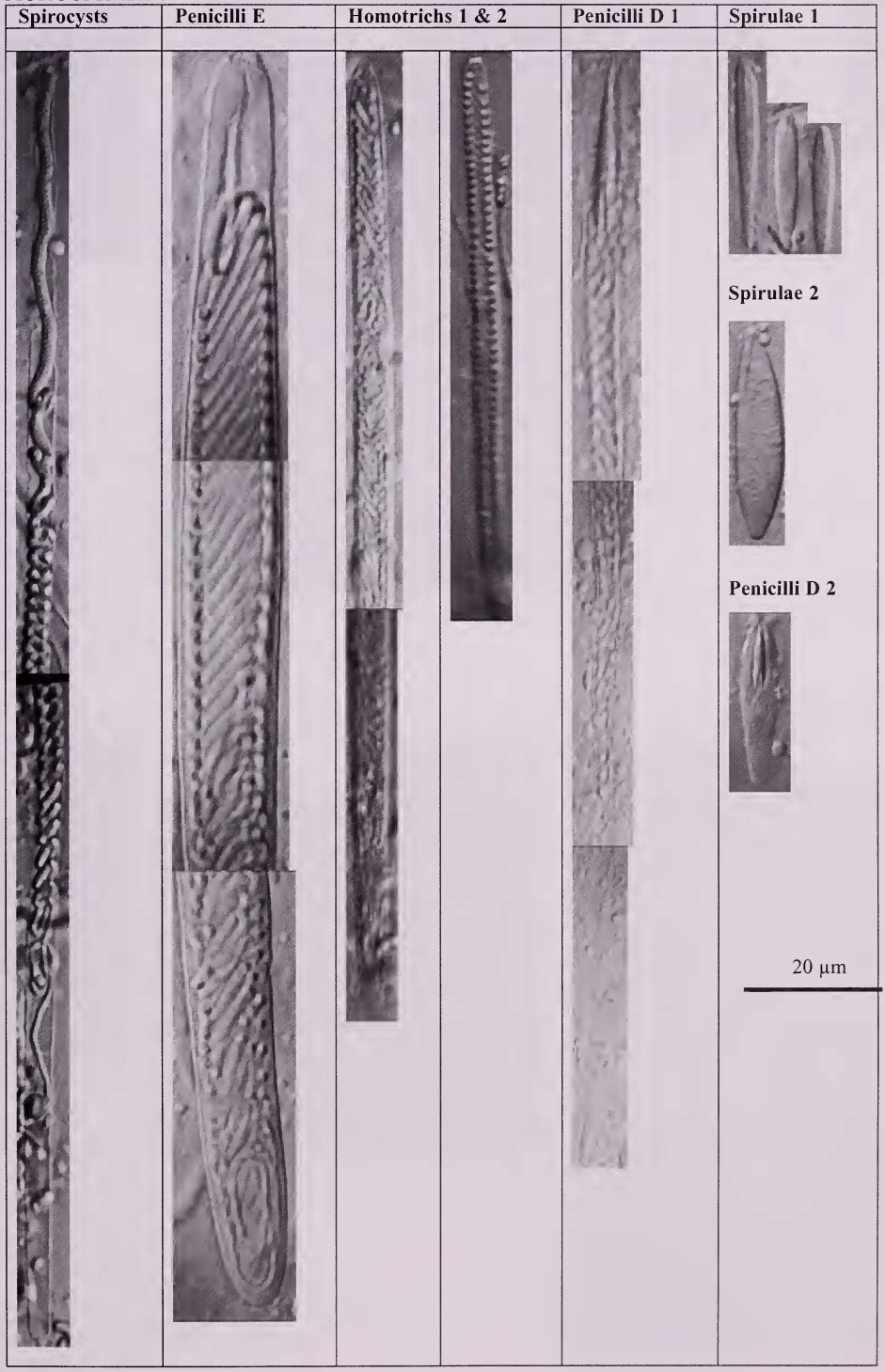
There are two spirocysts categories, one large (>100 μm and <250 μm) and a much smaller as known from other soft bodied coral species. We do not include these spirocysts measurements.

Table I.- *Paracorynactis hoplites*. Survey of the cnidom of three specimens from different localities. A: Coll. 31023: Indonesia, N Sulawesi; B: Coll. 31030: Indonesia, SW Sulawesi; C: Coll. 31036: Sta. S4.114: Indonesia, N of Sumbawa; D: Coll. 31031: Indonesia, SW Sulawesi; E: Coll. 31037: Sta. S4. 152: Indonesia, SW Salayer; F: Coll. 31038: Sta. S4. 152: Indonesia, SW Salayer. D, E & F showing the sizes classes present on tentacles and body wall

ORGAN	PROCEDENCE	NEMATOCYSTS TYPE	MEAN AND RANGE OF LENGTH AND WITH OF NEMATOCYST CAPSULES IN μm	N	FREQUENCY
Tentacles	A	Spirulae 1	25.5 (22-30) x 3 (2.5-3.5)	10	RC-UC
	B		22.2 (20-25) x 3.1 (3-3.5)	15	RC-UC
	C		25 (18-33) x 3.4 (3-3.5)	15	C-RC
	D		22.5 (17-30) x 3.1 (2.5-4)	10	RC-UC
	E		29.5 (25-34) x 3 (2.5-3.5)	6	UC-RC
	F		25.7 (23-31) x 2.8 (2-3.5)	10	RC-UC
	A	Spirulae 2	36.9 (35-40) x 6.5 (6-7.5)	11	RC-C
	B		31.3 (30-34) x 6.1 (6-6.5)	10	RC-UC
	C		34.8 (30-40) x 6.7 (6-8)	15	C-VC
	D		31 (27-35) x 6.2 (6-6.5)	2	R
	E		32 (27-37) x 5.5 (5-6)	8	UC-RC
	F		29.2 (27-32) x 6 (5-7)	4	UC-R
	A	Penicilli E	220 (185-250) x 18.9 (18-21)	15	C-RC
	B		194 (170-210) x 17.6 (16-20)	15	C-VC
	C		218 (190-250) x 20 (17-23)	10	RC
	D		186 (143-225) x 19.4 (16-22)	15	RC
	E		246 (215-260) x 19.3 (15-21)	15	RC-C
	F		217.8 (185-245) x 18 (14-23)	15	C-RC
	A	Penicilli D1	158 (150-165) x 5 (5-5.5)	10	C
	B		163 (155-170) x 5.6 (5-6)	10	C
	C		159 (150-175) x 5.1 (5-6)	10	C
	D		161 (140-185) x 5 (5-5.5)	10	C
	E		164 (153-180) x 5	15	C

ORGAN	PROCEDENCE	NEMATOCYSTS TYPE	MEAN AND RANGE OF LENGTH AND WITH OF NEMATOCYST CAPSULES IN μm	N	FREQUENCY
	F		175 (160-190) x 5.1 (4-6)	15	C
	A	Penicilli D2	30.8 (28-33) x 5.1 (4-6)	10	RC
	B		25 (20-30) x 5	8	RC-UC
	C		27.8 (25-31) x 5.1 (5-6)	10	RC-UC
	D		29.5 (29-30) x 5	5	R
	E		30x5	1	R
	F		29.5 (28-31) x 5 (5-5.5)	5	R-UC
	A	Homotrichs1	132.8 (112-150) x 5.6 (5-7)	10	RC-UC
	B		139 (130-145) x 5.5 (5-7)	10	RC-UC
	C		142.6 (125-158) x 5.7 (4-6.5)	15	C-VC
	D		142.3 (127-170) x 6.4 (5-7)	15	C-VC
	E		140 (135-145) x 6	5	RC-UC
	F		148.5 (136-160) x 5.6 (5-6)	10	RC
	D	Homotrichs2	82.4 (70-90) x 3.2 (2.5-4)	10	RC-UC
Pharynx	A	Penicilli E	92 (80-104) x 22.3 (20-26)	15	C
	B		77.7 (71-83) x 22.2 (20-24)	10	C
	C		101.6 (95-108) x 23.7 (20-25)	10	C
	A	Homotrichs	39.6 (32-45) x 4.6 (4-6)	15	C
	B		38.5 (35-42) x 4.5 (4-5)	15	C
	C		40.8 (35-47) x 4.6 (4-5)	20	C
Filaments	A	Penicilli E	101 (88-110) x 23.6 (15-25)	25	C-VC
	B		83.6 (70-95) x 26.4 (20-27)	10	C
	C		105 (87-117) x 25.4 (22-30)	20	C
	A	Penicilli D	41.3 (37-46) x 7.4 (7-8.5)	10	C
	B		36.2 (33-42) x 6.6 (6-7)	10	C
	C		41.6 (33-47) x 6.6 (5-8)	10	C
Body wall	A	Penicilli A	22.8 (20-25) x 6.5 (6-7)	10	RC-UC
	B		20.2 (15-25) x 6 (5-7.5)	20	C-VC
	C		21.4 (18-28) x 5.9 (5-7)	15	RC-UC
	D		20 (15-25) x 6 (5-7)	5	UC
	E		21.7 (20-24) x 5.9 (5-7)	10	RC
	F		23.2 (21-26) x 6.7 (5.5-7)	5	UC
	A	Spirulae	22.8 (20-27) x 6.1 (5-7)	10	RC-C
	B		19 (15-24) x 5.5 (4-7)	15	C
	C		20.8 (16-24) x 6.3 (6-7)	15	C
	D		21.4 (16-25) x 5.7 (5-6.5)	15	RC-C
	E		20 (14-27) x 5.6 (5-7)	15	RC-C
	F		20.7 (17-25) x 5.7 (5-6)	15	C
	A	Homotrich	33.5 (30-40) x 5.9 (4-8)	20	C
	B		28.7 (24- 32) x 6.2 (5-7.5)	15	RC
	C		32.3 (28-37) x 6 (5-7)	11	C
	D		35.5 (30-40) x 7.2 (7-8)	5	UC-RC
	E		31.4 (27-35) x 6.7 (5-8.5)	10	C-RC
	F		35.1 (28-37) x 6.8 (6-8)	10	C-RC

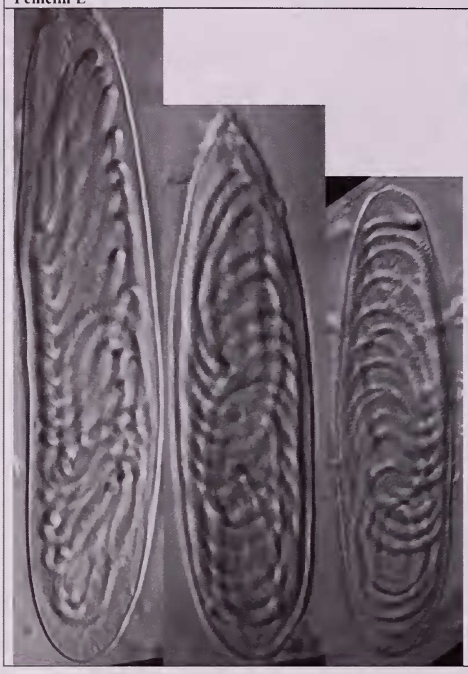
Figura 3.- Pictorial survey of the cnidom.



STALK

Homotrichs	Penicilli D
	

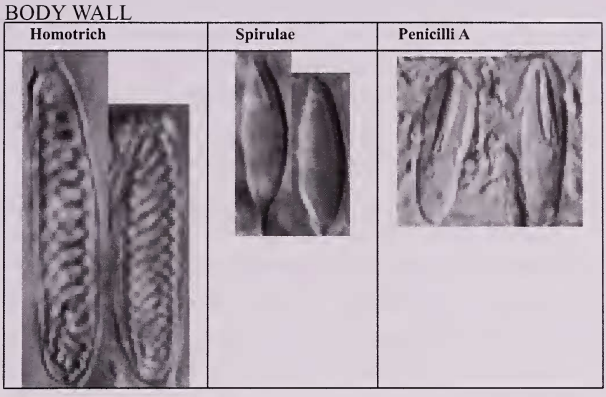
PHARYNX

Penicilli E	Homotrichs
	

FILAMENTS

Penicilli E 1	Penicilli E 2	Penicilli D
		

BODY WALL



Biological notes: In total, 70 life specimens of *Paracorynactis hoplites* were observed during 27 dives in the Davao Gulf between October 2007 and November 2008. The deepest observation was a specimen at 28 m depth, whereas specimens were also found in shallow water up to 2 m. The mean depth of the polyps was 7.3 m indicating that the majority of the polyps was found in relatively shallow water. The diameter of the polyps ranged from 4 to 17 cm with a mean of 9.6 cm.

A newly discovered predator of the crown-of-thorns starfish is a relevant example of how as the authors assume *Paracorynactis hoplites* may help control the crown-of-thorns population (BOS *et al.* [2], BOS [1]).

Remarks: The new genus presents intermediate characters between *Corynactis* and *Pseudocorynactis*. Acrospheres very prominent, with special spirocysts, and differentiated widely from stalk (den HARTOG [12] and DEN HARTOG *et al.*, *op. cit.*), stalk with nematocysts and less extending capability compared to *Pseudocorynactis*. The absence of a special structure (den HARTOG *et al.*, *op. cit.*) in the tentacle musculature enforce the assertion. This group of attributes makes to our present new genus a single one among the other genera belonging to the Corallimorphidae family.

We identified the studied material of the new genus to the species described by HADDON & SHACKLETON [11] on the base of the musculature (sphincter and mesenteries) showed by the first author (HADDON [9]: 467-468, plate XXX figs. 1-4., figs. 2 and 4) The color varieties described in both papers underline the previous assertion. They have been known from some time ago (see den HARTOG [14]; and present color data) and it is a good way to identify the species from others belonging to *Pseudocorynactis* genus. Furthermore, the habitat and geographical area of the material examined in the present study are highly comparable to those of Haddon & Shackleton's study. We included small specimens (see studied material) as did HADDON & SHACKLETON (*op. cit.*). Similarly, *Corynactis globulifera* was attributed to *Pseudocorynactis* a long time ago (den HARTOG *et al*, *op. cit*: 27) and apparently only small specimens have been found.

We assumed that the collection of HADDON & SHACKLETON [*op. cit.*] was in Dublin, but K.W. England informed J.C. den Hartog that the collection was with the Cambridge University. Unfortunately this material was not made available from Zoological Museum at Cambridge University. A re-examination of Haddon's material is highly desired

and may contain two different species (*Paracorynactis hoplites* and *Pseudocorynactis tuberculata*). In the case of no type material from Haddon's collection a new type series (Neotype) should be established with the material deposited in Leiden.

Corynactis hoplites was considered by den HARTOG *et al.* (*op. cit.*) a possible valid species, the second *Corynactis* recorded from tropical areas after *Corynactis parvula* Duchassaing & Michelotti, 1860 (den HARTOG *et al.*, op. cit.).

The absence of the *Corynactis* genus from the tropical Indo-Pacific areas should be taking into account. The presence of *Corynactis parvula* in certain areas from the Caribbean Sea may be an exceptional recent case that needs further study. It seems plausible to think that *Corynactis* is restricted to temperate waters (upper bathial in some cases) with the exception of *C. parvula* that can colonize some tropical environments and which merit to be studied separately. *Pseudocorynactis* and *Paracorynactis* are tropical-subtropical genera not known from temperate waters.

Genus *Pseudocorynactis* den Hartog, 1980

Additions to the diagnosis of the genus: *Pseudocorynactis* present the highest degree of tentacular differentiation from the shallow water genera (*Corynactis*, *Paracorynactis* and *Pseudocorynactis*). The stalk may extend enormously, more than the column length and the nematocysts are absolutely absent from the stalk. From the histological and microanatomical point of view, the stalk presents strong developed ectodermal longitudinal musculature supported by conspicuous, brush-like mesogloeal processes (see den HARTOG *et al.*, *op. cit*:31). The last comment should be included in the genus diagnosis.

Remarks in relation to the species *Pseudocorynactis caboverdensis* den Hartog, Ocaña & Brito, 1993: This species studied on the basis of a single specimen is better to be placed into the genus *Corynactis*. The species was tentatively included into the genus *Pseudocorynactis* (den HARTOG *et al.*, *op. cit.*) although strikingly resemble *C. parvula*. So, in the present paper, we include that species into the genus *Corynactis*. Meanwhile, much more information is needed to focus on both *Corynactis parvula* and *Corynactis caboverdensis*.

Corynactis caboverdensis presents nematocysts in the stalk of their tentacles and does not have large spirocysts in the acrospheres, which are characteristic of *Pseudocorynactis.* As we pointed out (see den HARTOG *et al.*, *op. cit.*) "In several respects *Pseudocorynactis caboverdensis* seems closer to species of the genus *Corynactis*". In addition, it should be taken into account that the habitat where the specimen was encountered at Cape Verde Islands is similar habitats as described for *Corynactis* spp. in other regions (see den HARTOG *et al.*, *op. cit*: 21; OCAÑA, *op. cit.*: 419).

Pseudocorynactis globulifera (Ehrenberg, 1834) com. nov.

Ectacmaea globulifera Ehrenberg, 1834: 39

Corynactis globulifera Kluzinger, 1877: 73, Taf. V. fig. 8.

Corynactis globulifera ? (Carlgren, 1900): 40, no figures, Baui island, Zanzibar. The measurements of the P-mastigophore E from acrosphere indicate close relation to *P. globulifera.*

Corynactis globulifera, 1943: 7-8, fig. 2. Short description of the material from Siam, comparative of nematocysts on the material from Siam, Zanzibar and the Red Sea.

Material.- Coll 39561: *Corynactis globulifera*, intertidal: attached to stone beneath sand. Ras Jarshyne, Aden. Collected by: K.W. England, 1966. K.W.England collection. 1 small specimen.. Images of the habitus of the specimen. 1.8 cm x 0.8 cm.
Other material analyzed:- ZMS 144: *Corynactis globulifera*, (Ehr) Roda havet, Koseir, Kluzinger 1855, Det. Kluzinger. Fragment van Berlin Museum.
ZMS 145: O. Afrika, Sansibar. Insel Baui, 29/6/1889, Stuhlmann (Fran Hamburg Mus.). Fragment van Stuhlmann exemplar.
ZMS 1264: *Corynactis globulifera*, Siam, of Koh Kut, 15 fms. Three specimens, T. Mortensen leg., 1900, id. O. Carlgren.

Diagnosis:

In preserved conditions (alcohol) the color is pale greyish, tentacles stalks transparent and acropheres of ochre color. Base irregular in outline, column marked by numerous distinct ridges, thick and cartilaginous in texture. Oral disk concave and the texture seems corrugate (fig. 4). Tentacles arranged in endocoelic radial rows, alternating with simple exocoelic ones. 48 endocoelic rows with 3-5 or mostly 4 tentacles each row. They are alternating with single exocoelic tentacles, the largest. In most cases, the penultimate tentacle is the largest, but sometimes it is the second large tentacle or about equal to the length of the ultimate tentacle. The total number of tentacles reaches 115. The oldest tentacles are relatively near to the centre of the oral disc. Tentacles stalk with high extensive capability.

There are 24 pairs of mesenteries with two pairs of directives. The directives separate a series of 10 to/and 12 pairs of mesenteries but the arrangement is not entirely clear. Primary and secondary mesenteries are perfect, tertiary cycle mostly imperfect, there are also some small of low development.

Sphincter endodermic and concentrated in the upper part of the column. Parietobasilar muscles well developed, enlarged restricted mesogloeal ridges in all the mesenteries (see fig. 4b).

Figura 4.- a) Specimen of *P. globulifera* from Aden collected by K. England; **b)** close-up of the parietobasilar ridges.

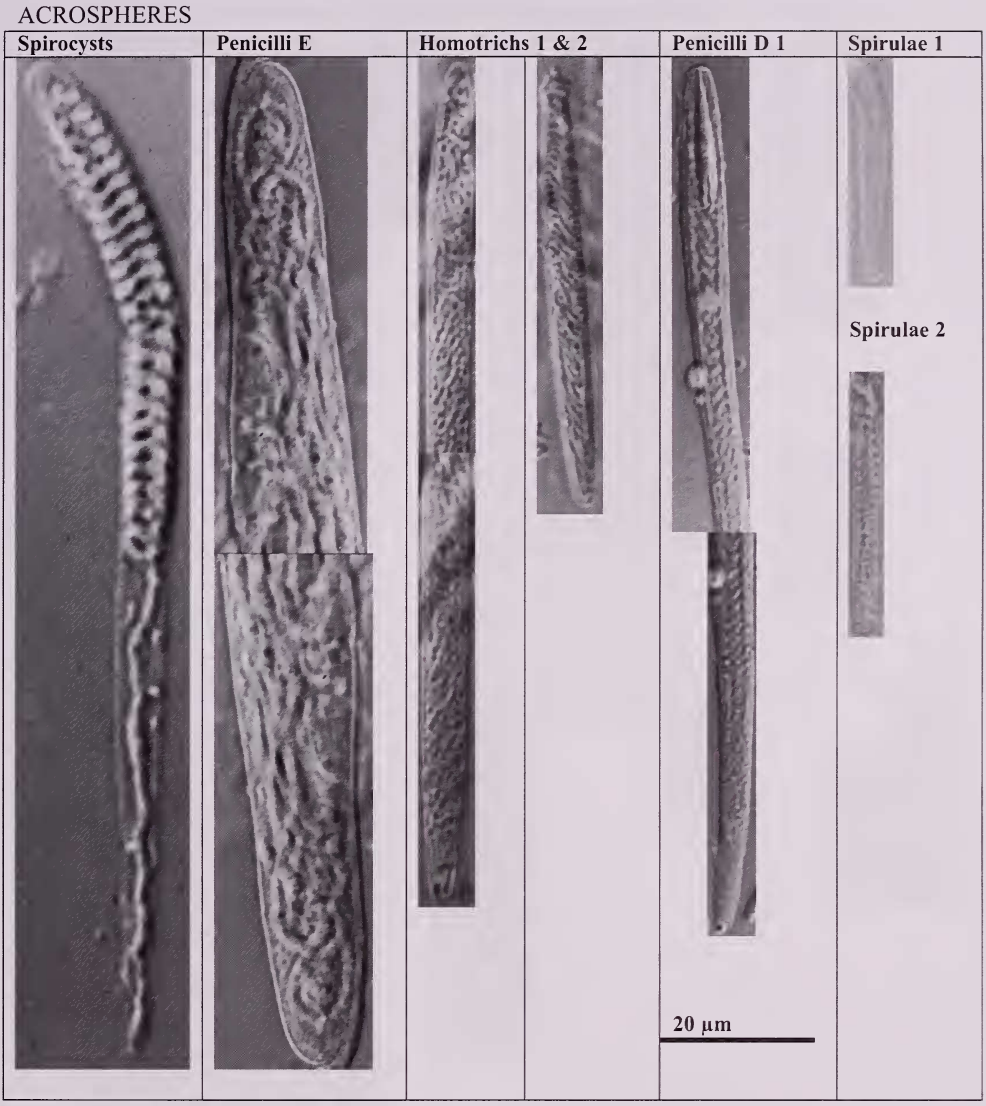
Cnidom (table II; fig. 5): A survey of the cnidom is summarized in the table II, adding some data from the other material analyzed.

We have analyzed the complete cnidom of one specimen collected by K. England in Aden. The small length of the P-mastigophores E, the scarcity of P-mastigophores E catego-

Table II.- *Pseudocorynactis globulifera.* Survey of the cnidom of the material from Aden collected by K. W. England: A. Additional information of the other analyzed material ZMS 144: B; ZMS 1264: C.

ORGAN	PROCEDENCE	NEMATOCYSTS TYPE	MEAN AND RANGE OF LENGTH AND WITH OF NEMATOCYST CAPSULES IN μm	N	FREQUENCY
Tentacles	A	Spirulae 1	27 (22-31) x 3.4 (2.5-4)	20	UC
	B		25.3 (21-28) x 3.1 (3-3.5)	5	UC
	C		24 (20-28) x 3.5 (3-4)	20	RC
	A	Penicilli E	110 (70-135) x 15 (13-20)	50	C-VC
	B		120 (118-130) x 17 (16-19)	10	C-VC
	C		119 (110-130) x 17.4 (15-19)	10	C-VC
	A	Penicilli D1	87.4 (75-100) x 4.5 (4-5)	15	C-VC
	B		101 (95-115) x 6.4 (6-7)	20	C-CV
	C		98 (85-110) x 6 (5-6.5)	15	C-VC
	A	Homotrichs1	90.4 (77-105) x 6 (4-7)	30	C-VC
	C		99.6 (90-110) x 6.5 (6-7)	20	C-CV
	A	Homotrichs2	56 (50-60) x 4.5 (4-5)	5	UC
Pharynx	A	Penicilli E	57 (54-60) x 20	2	R
	C		51.2 (45-55) x 17.3 (16-20)	10	UC
	A	Homotrichs	32.6 (32-40) x 5.3 (4-6)	20	RC-C
	C		30 (25-33) x 5.5 (5-6)	25	C
Filaments	A	Penicilli E1	115 (100-130) x 28 (19-30)	35	C-VC
	B		118 (105-25) x 26.5 (25-30)	10	RC
	C		100 (95-105) x 30	3	UC
	A	Penicilli E2	65 (55-75) x 21.6 (16-26)	25	C-VC
	B		63.4 (60-70) x 20.6 (20-22)	10	RC-UC
	C		62.7 (58-70) x 20 (17-25)	22	C-VC
	A	Penicilli D	24.2 (20-30) x 6.2 (5-7)	20	VC-C
	B		27.2 (24-34) x 7 (6-8)	20	VC-C
	C		26.3 (23-30) x 7 (6-8)	25	VC
	A	Spirulae	11.2 (10-14) x 3.5 (3-4)	20	C
	C		11.5 (10-15) x 3.5 (3-4)	15	C
Body wall	A	Penicilli A	25.8 (21-31) x 6.6 (5-7)	30	VC
	B		25.6 (21-28) x 6.1 (5.5-7)	20	C
	C		24.5 (18-30) x 6.5 (5-7)	30	VC
	A	Spirulae1	10.3 (7-12) x 3.4 (3-3.5)	20	UC-RC
	C		9.5 (8-11) x 3.7 (3-4)	15	RC
	A	Spirulae2	20.1 (16-23) x 5.5 (4-6)	20	UC
	B		20.4 (15-22) x 6.1 (5-7)	15	RC
	C		15.5 (13-18) x 5.5 (4-6)	10	UC
	A	Homotrich	37.4 (32-40) x 8.2 (7.5-9)	10	UC

Figura 5.- Pictorial survey of the cnidom.

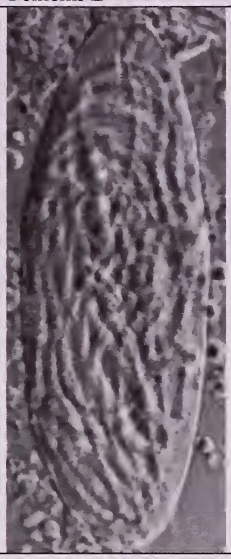
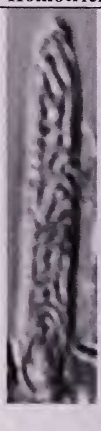


ry in the pharynx and the presence of small categories of spirulae are distinctive characters. We have not noticed any differences concerning to the size of the specimens studied. Nematocysts absent from the tentacle stalks. Spirulae 2 from tentacles very scarce.

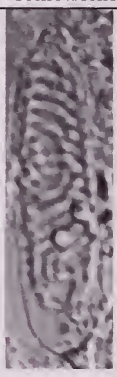
There are two spirocysts categories, one large (>100 µm and <150) µm) and the other smaller than usually found in other soft bodied coral species. We do not include these spirocysts measurements.

The homotrichs 2 have only been found in the specimen from Aden, although it is an uncommon nematocyst. In the pharynx of the specimen from Aden we found small and sporadic penicilli D. The pharynx from the specimen B was not studied due to poor conserva-

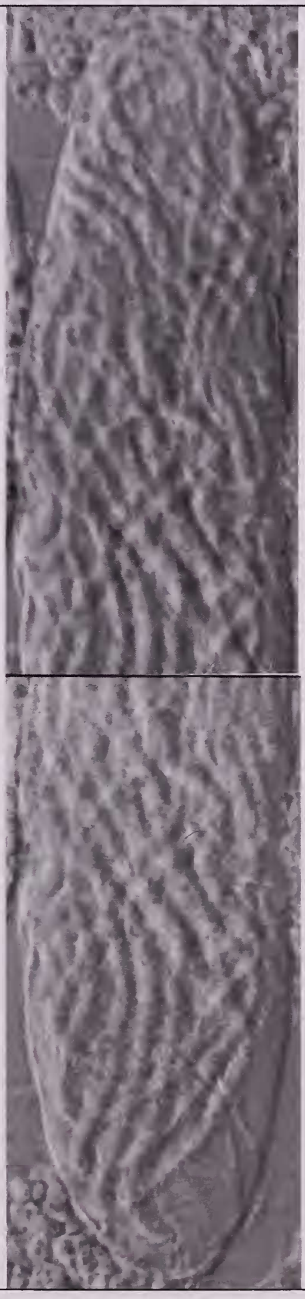
PHARYNX

Penicilli E	Penicilli D	Homotrichs
		

BODY WALL

Spirulae 2	Spirulae 1	Homotrichs	Penicilli D
			

FILAMENTS

Penicilli E 1	Penicilli E 2	Penicilli D
		
		Spirulae
		

tion of this particular tissue. In this specimen, spirulae from the pharynx were not observed. Possibly, due to the poor conservation, spirulae of small size and homotrich from the body wall, also in the specimen C, were not seen.

Notes about other material analyzed:

The material from Siam (see CARLGREN [4]) was on an eroded fragment of Xenophora-Caryophyllid coral. Base 10x6.5 mm, oral disc semi-contracted 13x10 mm, height of column 12 mm. Column with distinct prominent ridges corresponding to endocoeles (ectoderm partly macerated). 24 rows of 3-5 endocoelic tentacles alternating with 24 singleton exocoelics. Mesenteries arrangement of one half showed two pairs of directives and 11 pairs of mesenteries divided into perfect and imperfect ones. The color in preserved conditions is greyish with dirty ochre acrospheres. An abstract of the nematocyst measurements is shown in table II.

The material from the Red Sea, studied by Kluzinger, is not fully retracted but tentacles and acrospheres protrude. Diameter of the base 13 mm, somewhat spread, height in semi-contracted state 8 mm. Color in preserved conditions greenish brown with yellowish-brown-green acrospheres.

Remarks: CARLGREN (*op. cit.*) studied the nematocysts of the material from Siam (Mortensen Expedition) and additionally examined the cnidom of the material from Zanzibar, previously studied by himself (see CARLGREN [3]), and from the Red Sea, this last material had already been studied by KLUZINGER [16]. After his examinations, Carlgren concluded that all the material belonged to *Corynactis globulifera*. We had the opportunity to examine the same material as Carlgren (see material) and we have found out that the material present the same characters showed by Carlgren paper of 1943, especially concerning the nematocysts measurements. According to this, the length of the Penicilli E from acrospheres and the width of the homotrichs from the column are the main characteristics to differntiate *Pseudocorynactis globulifera* from other species of *Pseudocorynactis* and the species of the new genus *Paracorynactis*.

The color features described by KLUZINGER (*op. cit.*) are also coincident with our observations about the material from Aden.

The absence of the nematocysts in the stalks and its extension capacity makes clear that the species belongs to the genus *Pseudocorynactis*.

Nevertheless, examination of more material is needed in order to establish the distribution of this species along the Indo-Pacific.

Pseudocorynactis tuberculata n.sp.
(Figs. 6-8)

Type material: Coll. 31035: S4.106: Indonesia, NE of Komodo; 8º26.9'S119º37.9'E; depth 80 m; calcareous stones and nodules with Porifera, Bryozoa, rectangular dredge; 20-ix-1984. "Tyro" Indonesian-Dutch Snellius-II Exped. Two specimens. Image of the habitus of the specimen. 2.5 cm x 1 cm; 2.8 cm x 1.6 cm. complete specimen attached on the stone Holotype, sectioned specimen Paratype.

Coll. 31032: S4.016: Indonesia, Tukang Besi islands, Banda Sea, Kaledupa reef, E of entrance, 5º56'S 123º48'E, scuba diving & snorkelling, gently stoping reef, 1-10 m, 06/08-09-1984. "Tyro" Indonesian-Dutch Snellius-II Exped. One specimen. Images of the habitus of the specimen. 2.2 cm x 0.9 cm. Paratype.

Coll. 31033: S4.045: Indonesia, NE coast of Sumba, E of Melolo; 09º54.2'S120º43'E; coarse sand with shell gravel, some calcareous stones, depth 48-57 m; van Veen grab; 13-ix-1984. "Tyro" Indonesian-Dutch Snellius-II Exped. One specimen. Images of the habitus of the specimen. 2.5 cm x 1 cm. Paratype.
Coll. 31034: S4.051: Indonesia, NE coast of Sumba, E of Melolo; 09º53.5'S120º42.7'E; depth 75-90 m; calcareous stones, rectangular dredge; 13-ix-1984. "Tyro" Indonesian-Dutch Snellius-II Exped. One specimen. Images of the habitus of the specimen. 3.8 cm x 1.5 cm. Paratype.

Coll. 31039: Maldives, Kartu Atoll, Villingili, depth 12 m, night dive. 24-iii-1989. M. van der Knaap. One small specimen sectioned at the middle. Image of the habitus of the specimen. 1.3 cm x 0.7 cm. Paratype.

Coll. 31040: Maldives, Kanifinolhu, depth 10 m, night dive. 22-vi-1989. M. van der Knaap. One small specimen. Image of the habitus of the specimen. 0.8 cm x 0.4 cm. Paratype.

Diagnosis:

Base generally spreaded on substrate, upper part of the column marked by conspicuous tubercles without ectoderm, not with foreign particles adhered to mucous coat. It seems that tubercles are connected by narrow channels (fig. 7a). Definitely, there are specimens much more tuberculate than others. Color of column orange-red. Tentacles with developed acrosphere and a high extension capacity, arranged in endocoelic radial rows alternating with simple exocoelic ones. 24 endocoelic rows with 3-5, mostly 4 tentacles each, are alternating with single exocoelic tentacles, the largest. Nearly always the penultimate tentacle is the largest, and sometimes the second tentacle is as long as the ultimate tentacle, or the same length. The total number reaches 120-150 tentacles. Oldest tentacles are relatively near to the centre of the oral disc.

Figura 6.- Tubercles in two different specimens.

There are 24 pairs of mesenteries, directives should be present but were not recognized. All the mesenteries are perfect, but the third cycle present pairs of less development (especially because the slender parietobasilar ridge), giving the impression of imperfect ones.

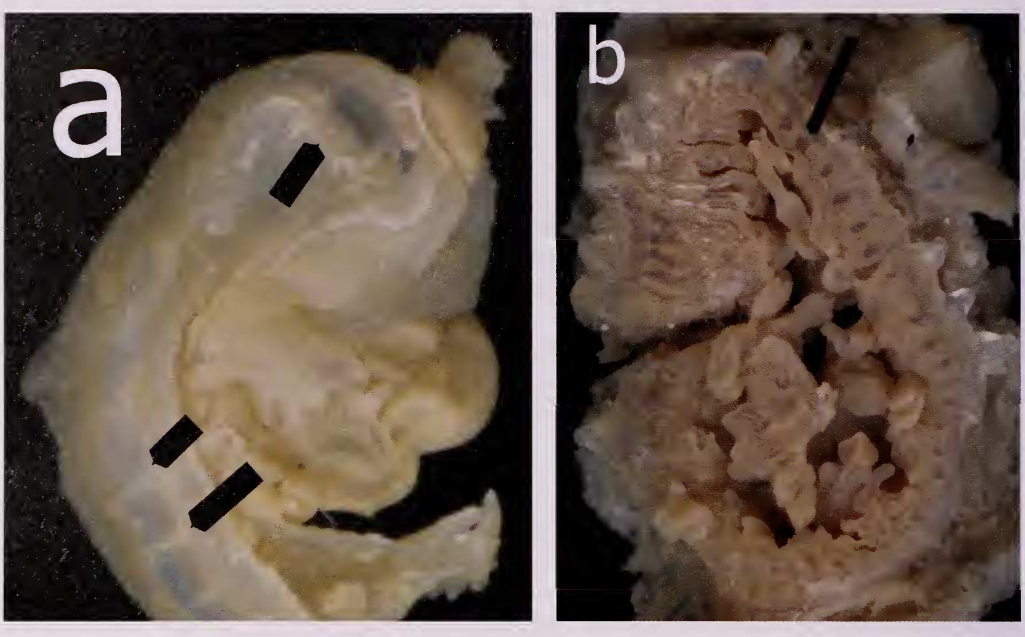


Figura 7.- a) Sphincter and connection channels of tubercules; **b)** Parietobasilar mesogloeal ridges.

Sphincter endodermic and concentrated in the upper part of the column (fig. 7a). Parietobasilar muscles well developed and encircled, restricted mesogloeal ridges in all the mesenteries (fig. 7b).

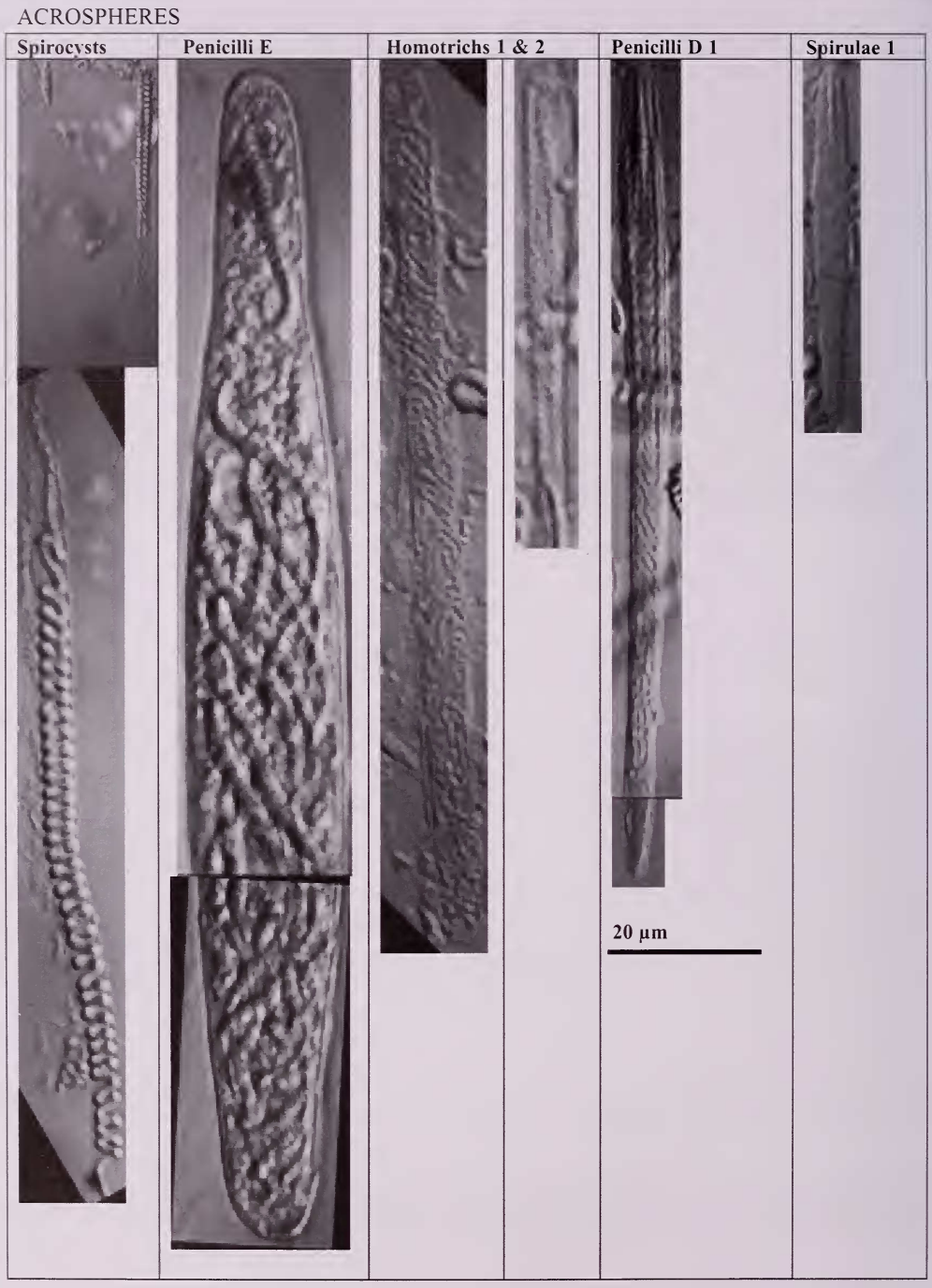
Cnidom (fig. 8): A survey of the cnidom is summarized in the table III. The presence of two penicilli D categories in the column, one common and the other uncommon or sporadic, is characteristic from the body wall. Normally there are size differences of the spirulae from tentacles among specimens, also seen in *P. caribbeorum* material. Nematocysts absent from the tentacles stalk. Fortunately, we have not noticed relevant differences concerning the size of the specimens studied. In the small specimens from Maldives there are some nematocyst size differences compared to the other studied material. Although these differences have to be understood in relation to the intra-specific variability and they do not significantly affect, in order to distinguish the species properly.

Table III.- *Pseudocorynactis tuberculata*. Survey of the cnidom of two specimens from different localities. A: Coll. 31039: Maldivas; B: Coll. 31033: Indonesia, C: Coll. 31034: Indonesia; D: Coll. 31032: Indonesia; E: Coll. 31035 Indonesia. C, D & E showing only the sizes classes present on tentacles and body wall.

ORGAN	PROCEDENCE	NEMATOCYSTS TYPE	MEAN AND RANGE OF LENGTH AND WITH OF NEMATOCYST CAPSULES IN μm	N	FREQUENCY
Tentacles	A	Spirulae 1	35 (30-45) x 4.6 (3.5-5.5)	30	RC-C
	B		49.7 (40-55) x 4.3 (4-5)	20	RC-UC
	C		45.6 (40-50) x 4.2 (4-5)	10	RC-UC
	D		41 (40-45) x 4.1 (4-4.5)	5	UC
	E		52 x 4	1	UC

ORGAN	PROCEDENCE	NEMATOCYSTS TYPE	MEAN AND RANGE OF LENGTH AND WITH OF NEMATOCYST CAPSULES IN μm	N	FREQUENCY
	A	Penicilli E	156.4 (125-190) x 20.6 (12-28)	30	C-RC
	B		161 (145-180) x 20.6 (12-25)	10	RC-UC
	C		175 (165-180) x 20.3 (20-21)	5	RC
	D		158.7 (145-170) x 18.2 (17-20)	5	RC-UC
	E		166 (160-175) x 18.6 (18-20)	5	RC-UC
	A	Penicilli D1	117.2 (98-140) x 6.1 (5-8)	30	C-RC
	B		129.2 (100-145) x 5.1 (5-6)	20	C-RC
	C		114.6 (105-127) x 5.5 (5-6)	5	RC
	D		117.5 (105-130) x 5 (4-6)	5	RC
	E		135 (130-140) x 5.5 (5-6)	5	RC
	A	Homotrichs1	96.6 (90-100) x 5.3 (5-6)	5	R
	B		106 (95-130) x 5.7 (5-6)	10	UC
	C		105 (100-110) x 5.7 (5-6)	5	R
	D		110 x 6	1	R
	E		100 x 5.5	1	R
	A	Homotrichs2	65 x 4	1	R
	B		55 x 3.5	1	R
	C		50 x 3	1	R
Pharynx	A	Penicilli E	64.3 (54-73) x 24.5 (19-31)	30	C-RC
	B		77.2 (65-90) x 27 (20-32)	20	C-RC
	A	Homotrichs	32.3 (25-38) x 6 (5-7)	30	RC-C
	B		30 (25-35) x 5.2 (4-6)	15	UC-RC
Filaments	A	Penicilli E1	84.2 (70-100) x 37 (28-48)	30	C-RC
	B		82.3 (75-90) x 33 (25-43)	25	VC-C
	B	Penicilli E2	64 (63-65) x 20.5 (20-21)	2	R
	B	Homotrichs	29.6 (27-33) x 4.6 (4-6)	10	UC
	A	Penicilli D	24 (20-28) x 7 (5-8)	40	RC-C
	B		20.3 (20-26) x 6.2 (5-8)	15	RC
Body wall	A	Penicilli D1	37.8 (27-46) x 10.5 (8-12)	30	UC-R
	B		43.6 (35-51) x 10.6 (8-13)	5	R
	A	Penicilli D2	22.5 (15-26) x 6.4 (5-8)	60	RC
	B		22.3 (17-27) x 4.7 (3.5-7)	20	RC
	C		18.3 (16-22) x 4.3 (4-5)	5	UC-RC
	D		19 (17-24) x 5.7 (5-7)	5	UC-RC
	E		19.3 (16-22) x 6.6 (5-8)	5	UC-RC
	A	Spirulae 1	23.2 (20-26) x 6.8 (5-8)	30	UC
	B		22 (19-25) x 5 (4-6)	5	UC-R
	A	Spirulae 2	12 (11-14) x 3.8 (3-4)	15	RC
	A	Homotrich 1	42 (33-50) x 17 (15-20)	45	C
	B		38 (32-45) x 16 (13-20)	25	C-RC
	C		39 (35-40) x 14.5 (14-15)	5	RC
	D		37.5 (35-40) x 16 (15-17)	5	RC
	E		36.5 (36-37) x 12	5	RC
	A	Homotrich 2	19.5 (19-20) x 4.5 (4-5)	2	R

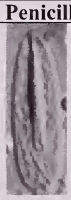
Figura 8.- Pictorial survey of the cnidom.



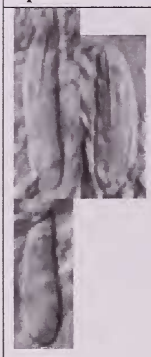
PHARYNX

Penicilli E	Homotrichs	Spirocysts
		

FILAMENTS

Penicilli E 1	Penicilli E 2	Penicilli D
		 Homotrichs 

BODY WALL

Spirulae 1	Spirulae 2	Penicilli D 1	Penicilli D 2	Homotrichs 1
				 Homotrichs 2 

In the filaments the penicilli E2 and the homotrichs have only been noticed on B specimen. Perhaps this is due to the contamination process with the pharynx. In the body wall from C, D and E spirulae were not observed. Homotrichs 2 are sporadic in the specimen D so it is not important to the taxonomical concern.

Remarks: The presence of tubercles (absolutely absent from *P. caibbeorum*) and some other size differences among nematocysts suggest to us to maintain these two close species separate (*Pseudocorynactis caribbeorum* and *Pseudocorynactis tuberculata). P. caribbeorum* is distributed in both Atlantic tropical areas, so it is plausible to suppose that *P. tuberculata* may be widespread in the Indo-pacific region. The scarce divergence between both species may be tentatively explained due to the short period of time that both, the Atlantic and the Indo-pacific populations, have been geographically separated. After all, 1.8 millions years ago, the Panama isthmus was closed (CRONIN & IKEYA [7]).

Tubercles are usually evident but sometimes, this character can be less conspicuous. Fortunately, there are other nematocyst evidences to enforce the distinction of both species too. The presence of narrow homotrichs 1 in the body wall of *P. caribbeorum* makes the most significant difference in terms of nematocysts measurement. Other morphological characters of *P. caribbeorum* can be consulted (den HARTOG *et al.* [15]; OCAÑA [17])

According to the ecological data available to us, the nocturnal predator is also applicable to this new species. As usually happens in the case of *P. caribbeorum* the body wall of *P. tuberculata* is also hidden in a crevice while the tentacle crown forms a net ready to prey.

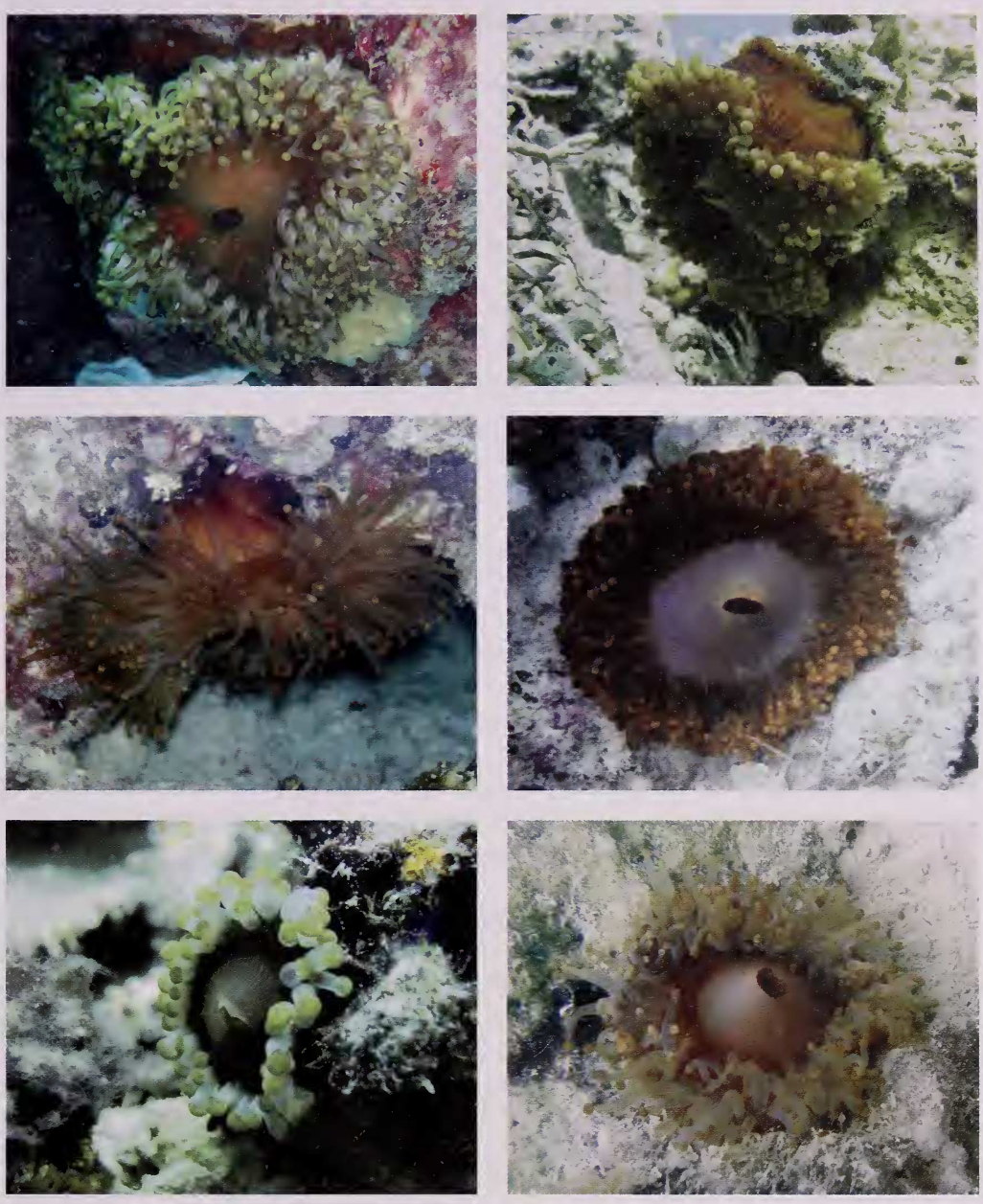


Figura 9.- *Paracorynactis hoplites* color and habitats, specimens recorded at Davao Gulf (Samal and Talikud Islands).

4. ACKNOWLEDGEMENTS

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